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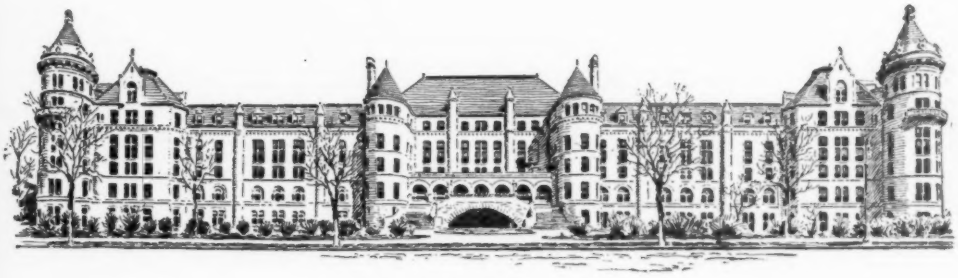
THE AMERICAN MUSEUM JOURNAL



WITH SUPPLEMENTARY GUIDE LEAFLET ON

THE COLLECTION OF MINERALS

Published by the AMERICAN MUSEUM OF NATURAL HISTORY
New York City

American Museum of Natural History

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THE AMERICAN MUSEUM OF NATURAL HISTORY was established in 1869 to promote the Natural Sciences and to diffuse a general knowledge of them among the people, and it is in cordial coöperation with all similar institutions throughout the world. Since the Museum authorities are dependent upon private subscriptions and the dues from its members for procuring needed additions to its collections and for carrying on explorations in America and other parts of the world, the attention of persons interested in such matters is called to the brief statement of deeds and needs on the fourth page of the cover of the Supplement.

UINTACRINUS SOCIALIS—Grinnell. FOSSIL CRINOID FROM KANSAS.

The American Museum Journal

VOL. II. FEBRUARY, 1902 NO. 2.

THE JOURNAL presents with this issue a general Guide Leaflet to the Halls of Minerals which will be found of great assistance by persons visiting and inspecting the collections therein. Just before Thanksgiving Day last year the hall was opened, first to members of the Museum and their friends and afterwards to the general public, with the great acquisition of the Bement mineral collection all in place. This collection had long had the reputation of being the finest private collection of exhibition specimens of minerals in the world, so that the Museum authorities felt that they were indeed to be congratulated when a munificent friend of the institution somewhat more than a year ago presented the whole to the Museum, including the magnificent collection of meteorites, which is one of the largest assemblages in existence of those interesting visitors from space. Practically nothing but the Bement collection is now on exhibition in the desk cases of the Mineral Halls, but all the best specimens in the previous Museum collection have been retained and have been arranged in systematic order in the drawers of the desk cases, awaiting the time when more exhibition space shall be available for minerals.

A REMARKABLE SLAB OF FOSSIL CRINOIDS.

IN November, 1901, the Department of Geology and Invertebrate Palæontology received from Frank Springer, Esq., of East Las Vegas, New Mexico, the gift of a large slab of the fossil Crinoid which is known to science as *Uintacrinus socialis* Grinnell. This Crinoid is characteristic of the Niobrara Chalk

UINTACRINUS SOCIALIS—Grinnell. AN INDIVIDUAL FROM THE SLAB. NATURAL SIZE.

horizon of the Upper Cretaceous of western Kansas. This slab, which is five feet four inches long and three feet two inches wide, in extreme dimensions, has been mounted and is now on exhibition in Panel 1 of Case P on the west side of the Geological Hall (No. 405) on the fourth floor of the Museum.

Crinoids belong to the same great subdivision of the animal kingdom as the common modern Starfish, but they are of a lower grade of organization. Some forms are provided throughout life with stalks, or stems, the lower ends of which are rooted in the mud of the sea-bottom or attached to some foreign object. Other forms, like the *Comatula* of the present seas, had such stalks during the very early stages of their existence, but lost them afterwards and floated free in the water. Crinoids seem to have been most abundant both in species and in individuals, during Lower Carboniferous (late Palæozoic) time, but, for the most part at least, they were stalked forms, leading a stationary existence. The free forms were more abundant later and now are very numerous, more than two hundred species of the family Comatulidæ having been described from the present ocean. *Uintacrinus* was a free form and has been found only in beds of Upper Cretaceous age.

The first specimen of the genus was found in 1870 by Prof. O. C. Marsh in the Uintah mountains in northeastern Utah. The Kansas specimens have added very greatly to our knowledge of these beautiful animals and have g ven Mr. Springer the material from which he has been able to complete the morphological studies of the genus made by Mr. F. A. Bather of the British Museum on European material. Mr. Springer's conclusions have been published in an elaborate memoir by the Museum of Comparative Zoölogy of Harvard University with several plates.

The investigations of Mr. Springer and others at the best localities show that these Crinoids lived in populous colonies in the quiet mediterranean sea or lagoon which occupied western Kansas in Cretaceous times. Those Crinoids that were at the lowest part of the floating mass rested directly upon the soft mud and settled into it in the positions in which they happened to be when the colony died. These were thus perfectly imbedded by

the lower side in a fine matrix which preserved them like a mould. The other individuals of the colony settled down on top of these and, not having a soft or plastic bed to receive and preserve them, were crushed out of shape and disarticulated, and their component plates were indiscriminately mixed up. The whole mass was cemented together under pressure, forming a slab,—a thin layer of limestone as we now find it,—with the Crinoid bodies preserved only on its lower side. The largest of these lenticular layers of limestone was about fifty feet long and twenty feet wide with a thickness of half an inch in the middle, thinning out on all sides to the thinness of cardboard. More than twelve hundred specimens in which more or less of a calyx was shown were obtained from this deposit. The arms of these Crinoids are so mingled in the slab that it was impossible to free any of them, but some of them have been traced to a distance of forty inches from the body to which they belong.

The slab which the Museum has received from Mr. Springer shows distinctly at least sixty-five bodies, while fifteen or sixteen more can be made out under the covering of entangled arms. The body or calyx had thin walls, the plates of which were apparently connected by a sort of articulation or loose suture, so that it was more or less flexible and comparatively light in weight. All the calices have been flattened so that the opposite walls have been brought together in the form of a watch crystal.

E. O. H.

THE DEPARTMENT OF PUBLIC INSTRUCTION.

TWO letters which have been recently received by Professor Bickmore give very gratifying evidence of the spreading influence of the Department of Public Instruction under his control. Persons who are in the habit of attending the lectures at the Museum know the popularity of the courses by Professor Bickmore and appreciate the superb character of the views thrown on the screen, but the extent to which these lectures and views are being used in the public schools of the State and the demand

that there is for them outside of the State and the country are not so familiar to all. Light upon both of these points will be thrown by the following letters, the first of which came from an entire stranger to Professor Bickmore and gives an indication of what is going on in the schools of central New York.

PHELPS, N. Y., Dec. 23, 1901.

DEAR SIR:—

I began to give your lectures in the school chapel two years ago, using acetylene, but last year I got the building wired and now use electricity, which is more satisfactory. I first gave "Niagara Falls" to an audience mostly of scholars. Gradually my audiences have increased until now I have about 175–200 each night, of people who come each time and who are delighted with the views and the information gained.

I usually go over the views with your notes four or five times after my duties are over for the day and then read the notes, keeping in mind the slide described, until I know the principal facts of each view. I give a talk of about one and one-half hours.

I have given Egypt, Greece, Italy, Niagara, Cuba and Spanish War, Yellowstone National Park, Grand Cañon, Yosemite, Atlantic Coast, two on the Hawaiian Islands, one on the Philippines, Lesser Antilles and the Connecticut Valley.

. . . . . .

At Clifton Springs and Shortsville, adjoining villages, similar courses are given [by the principals there]. If other parts of the State are doing the same, you are doing a great work in giving useful information to the people. I think greater efforts should be put forth to inform Union School Principals of the fact that they may obtain these views from cities and villages having a Superintendent.

Very truly yours,

(Signed) WILLIS A. INGALLS,

Principal of Schools.

The second letter is from the head of the school system of the Philippine Islands and shows the value placed there upon the stereopticon and first rate lantern slides in the work of instructing the Filipinos in regard to their new masters. The letter is an ex-

cellent testimonial to the system of "visual instruction" which has grown up under the auspices of this Museum.

MANILA, November 11, 1901.

DEAR SIR:—

I have not forgotten the interesting visit which I made to your Museum before leaving New York.

We have just ordered nine magic lanterns and desire to present, in illustrated lecture form, as much information about American history and life as possible. What arrangements can be made with you to secure slides and what can we do as a return favor to you?

Considerable has been done in establishing schools and the Department now desires to give some attention to public libraries and public lectures, because they are very important supplementary educational agencies. Any suggestions that you may be willing to make will be very helpful.

With kindest regards, I am,

Very truly yours,

(Signed) FRED. W. ATKINSON,
Superintendent of Public Instruction
for the Philippine Islands.

THE ANDREW J. STONE EXPEDITION.

THE first season's work of the Andrew J. Stone Expedition has proved very successful and satisfactory. This expedition was organized early in the year 1901, and its work will continue during a period of three years, the means therefor having been generously contributed by public-spirited citizens of New York. It is under the leadership of Mr. Stone, who has several expert assistants to help carry on the work.

The purpose of this expedition s primarily to secure for the Museum good series of all the large game animals of North America, many of which are as yet unrepresented in its collections and are on the way to rapid extermination. The more prominent and interesting species will be mounted as groups with proper accessories and will form one of the most attractive features of

the Museum collections. The smaller mammals and birds obtained by the expedition will be of special value to the Museum, since the more northern parts of the Continent are thus far very poorly represented here as regards the mammals and birds.

The season of 1901 was spent partly on the Kenai Peninsula and partly on Kadiak Island and the adjoining mainland of Alaska. Mr. Stone's assistants were Mr. J. D. Figgins of the American Museum and Mr. Maynard of Seattle, Washington. The collections comprise about forty large mammals, including good series of Caribou, Mountain Sheep and Moose, and of several species of Bear, besides several hundred small mammals and a large collection of birds

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NEWS NOTES.

THE collections of the Department of Vertebrate Palæontology were enriched in January by the receipt of an excellent skull of the Woolly Rhinoceros (*Rhinoceros tichorhinus*) from the Pleistocene deposits of Russia. This specimen has come through Professor Alexis Pavlow and Madame Marie Pavlow of the University of Moscow, in exchange for material from the western United States, and will soon be placed on exhibition.

The skeleton of *Ichthyosaurus quadriscissus* which was noticed at length in the JOURNAL for October, 1901, has been further worked out of its rocky matrix, re-set and soon will be mounted in the corridor over the great Mosasaur skeleton.

The attention of visitors is called to the series of water-colors by Mr. Charles R. Knight, showing the different forms of the modern Zebra, and displayed in connection with the series illustrating the evolution of the Horse.

THE Department of Anthropology has received from J. D. Crimmins, Esq., the gift of a series of fifteen native Filipino hats. These were collected by his son, Lieut. Martin L. Crimmins, Sixth Infantry, U. S. A., who is now stationed on the Island of Pane, Philippine Islands.

SOME of the material collected by Dr. Berthold Laufer in China, mentioned in the JOURNAL for January, has been placed on exhibition in the northeastern quarter of Hall No. 207, on the main floor of the building. The most striking objects are four ancient bronze drums, ancient and modern examples of carving, baskets and richly-embroidered garments and cloths. Only sixteen bronze drums of this character are known to be in existence.

THE Andrew Ellicott Douglas collection of celts and other Indian implements is being installed in the Tower Room at the extreme southwest corner of the main floor.

THE Section of Archæology has received an exchange from the Buffalo Society of Natural History, consisting of a representative collection from a village site in the southern part of Buffalo. This site was inhabited in historic times by the Seneca Indians, at whose head was the famous chief, Red Jacket. In prehistoric times the same site was occupied by the Kah-Kwahs, another division of the Iroquois people, who spoke a related language and had kindred customs. In the early days this site was neutral ground, because it was near the quarry of chert, the material which all tribes alike needed for making arrow-points. When the Senecas, however, secured guns and no longer used chert-pointed arrows, they captured the site from the Kah-Kwahs, an event which took place early in the seventeenth century. The present collection was made by Mr. Frederick Houghton, principal of one of the Buffalo schools, and is very complete. The implements represent both the Seneca occupation and that of the prehistoric Kah-Kwahs, and are accompanied by full information regarding the circumstances of their finding and their probable use. The collection is on exhibition in Hall No. 208, on the main floor of the building.

THE Anthropological Department has also received, as a gift from the Peabody Museum of Cambridge, Massachusetts, one of the Mexican codices which have been prepared through the liberality and under the editorship of Mrs. Zelia Nuttall.

THE Department of Entomology has received from the Very Reverend E. A. Hoffman about six hundred and fifty specimens of butterflies from Australia, British New Guinea and other parts of the globe. All the forms are new to the collection, and there are many rare and beautiful species among them. Including this gift, the department received more than nine hundred specimens from this generous friend of the Museum during the year 1901.

THE Department of Geology has placed on exhibition on the tops of some of the cases containing the Jesup Collection of Building Stones on the ground floor of the Museum a series of specimens illustrating the building stones of Georgia. These specimens are in the form of handsome eight-inch cubes, with one face polished and the others finished in different styles to show the appearance of the material when treated according to several methods of the stone-dresser's art. The series comprises thirty-eight of these cubes, and includes gray, homogeneous granite of several shades, porphyritic granite and gneiss, sandstone, limestone and mottled and white marble. The collection was made for the State of Georgia by the State Geologist, Dr. W. S. Yeates, and has been exhibited at the expositions held at Atlanta, Nashville and Buffalo. It has been deposited in the Museum by the Geological Board of Georgia as an exhibit of the resources of the State in regard to building stones.

THREE important parts of the Memoirs of the Museum were issued in January as results of the explorations carried on by the Jesup North Pacific Expedition. They are, "The Traditions of the Quinault Indians," by Dr. Livingston Farrand, assisted by W. S. Kahnweiler, forming Part III of Vol. IV of the whole series of Memoirs; "Kwakiutl Texts," by Professor Franz Boas and George Hunt, forming Part I of Vol V; and "The Decorative Art of the Amur Tribes," by Dr. Berthold Laufer, forming Part I of Vol. VII. The Quinault Indians live on the coast of the State of Washington, while the Kwakiutl tribe lives in British Columbia. In the Memoir, the Kwakiutl texts and the English translations thereof are arranged in parallel columns. Dr. Laufer's paper is

elaborately illustrated with thirty-three plates, some of which are in colors, and twenty-four text figures.

THE official record shows that 50,607 persons visited the Museum during the month of January, 1902.

LECTURE ANNOUNCEMENTS.

DURING March the following lectures will be delivered at the Museum by Professor Albert S. Bickmore:

To Teachers in the Public Schools: Saturday mornings at 10.30 o'clock:

March 1st and 8th.—"The Upper Rhine."
March 15th and 22d —"The Lower Rh ne."

To the Members of the Museum and their friends, on Thursday evenings at 8.15 o'clock:

March 6th.—"The Upper Rhine."
March 13th.—'The Lower Rhine."

The illustrations for these pictures have been prepared from negatives taken last summer expressly for Professor Bickmore.

THE lectures given under the auspices of the City Board of Education will be continued throughout the month on Tuesday and Saturday evenings at 8 o'clock precisely.

Publications

OF THE

American Museum of Natural History

ANNUAL REPORT: Octavo, about 80 pp.

BULLETIN: Octavo; annual; about 400 pages and 25 plates with numerous text illustrations. Articles relate about equally to Geology, Palæontology, Mammalogy, Ornithology, Entomology and (in recent volumes) Anthropology.

MEMOIRS: Quarto; issued in parts at irregular intervals, several parts being published annually. One volume has been completed and six are now under way. Each part forms a separate and complete monograph, varying in size from 24 to 100 or more pages, with numerous plates, mostly lithographic.

JOURNAL: Octavo; in numbers, one volume annually; illustrated. A popular record of the progress of the Museum, each number containing a Supplement which is a Guide Leaflet descriptive of some exhibit or group of exhibits in the Museum.

American Museum Journal

EDMUND O. HOVEY, *Editor.*

FRANK M. CHAPMAN,
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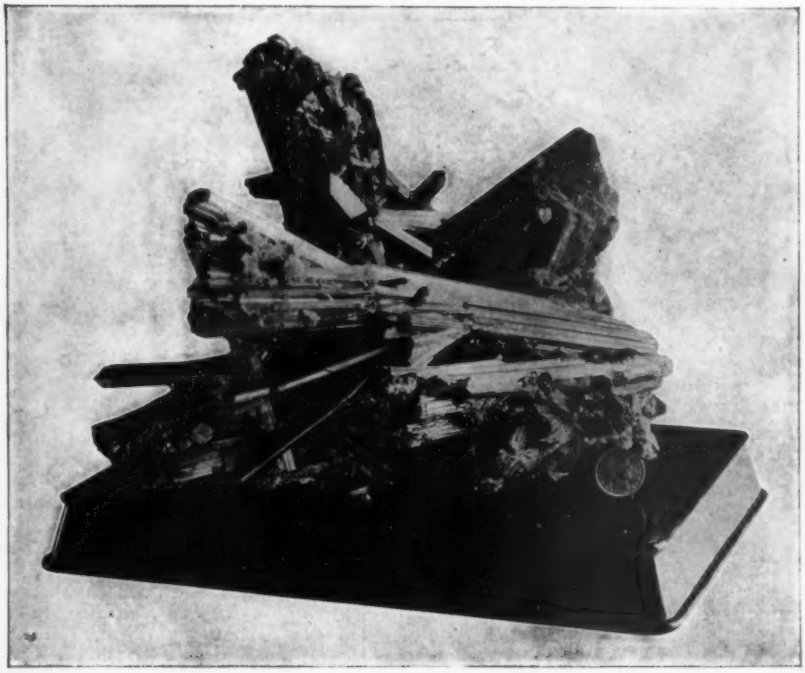
THE COLLECTION OF MINERALS (GUIDE LEAFLET)	Supplement

AMERICAN MUSEUM OF NATURAL HISTORY

The Collection of Minerals



BY

Louis P. Gratacap, A.M.

Curator, Department of Mineralogy

SUPPLEMENT TO AMERICAN MUSEUM JOURNAL
VOL. II, No. 2, FEBRUARY, 1902
Guide Leaflet No. 4

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THE MAIN HALL, DEPARTMENT OF MINERALOGY

THE COLLECTION OF MINERALS.

By Louis P. Gratacap, A.M.,

Curator, Department of Mineralogy.

Introduction.

Minerals, in the broad sense in which science uses the term, include the air, the natural gases, water and the results of change in plant structures, such as coal, oil and resins. More popularly defined, minerals are those stony components of the earth which are to be found in its rocks and their crevices and which present similarity to one another in such characteristics as color, form and hardness. Most observers can easily separate Quartz from Calcite. In making the separation they associate with the idea of Quartz a certain lustre and hardness, a peculiar brittle and irregular fracture and, when the mineral is crystallized, a typical form quite in contrast with the same features in Calcite. A brilliant lemon-yellow crystal, or even a compact mass of Sulphur, is quite distinct in appearance from a greasy, black crystal or nodular piece of Graphite. The obvious physical characters of one are so different from those of the other that the most cursory examination serves to distinguish them as independent substances.

Such striking contrasts, however, do not exist generally in the mineral kingdom, and the observer usually is obliged to give more than a superficial examination to a mineral specimen in order to determine what it is. Most of the common minerals may be differentiated by simple tests with blowpipe and file, but all the rest, and they form by far the largest part of the whole number of species, must be examined by more elaborate chemical and physical means for their exact determination.

The collection of minerals to which this Guide Leaflet is an introduction, though large and comprehensive, cannot be considered an exhaustive representation of the mineral kingdom. It combines, however, in almost equal degrees the elements of

beauty, scientific interest and educational use. The æsthetic influence of a collection of minerals need not be dwelt upon. It is evident that minerals are beautiful in their colors, in their varied forms and, sometimes, in the extreme delicacy of their development.

The History of the Collection.

The growth of the Mineral Collection of the American Museum has been gradual. Its nucleus was the Bailey collection, which contained many of the more common minerals and, while not conspicuous for beauty or completeness, was a fairly representative series serving very well the purpose of an introduction to mineralogy. The Spang collection was purchased in 1891 and more than doubled the number of specimens of minerals in the Museum. This acquisition, furthermore, added a large number of new species, and in many groups increased the variety and richness of form represented.

Previous to the purchase of the Spang collection, a very remarkable group of specimens of Malachite and Azurite (the green and blue carbonates of copper) had been presented to the Museum by the Copper Queen Consolidated Mining Company of Arizona. This unique and very striking assemblage of specimens, together with later additions from the same source, is now installed in the large single case at the north end of the smaller hall (lettered "B" in the diagram).

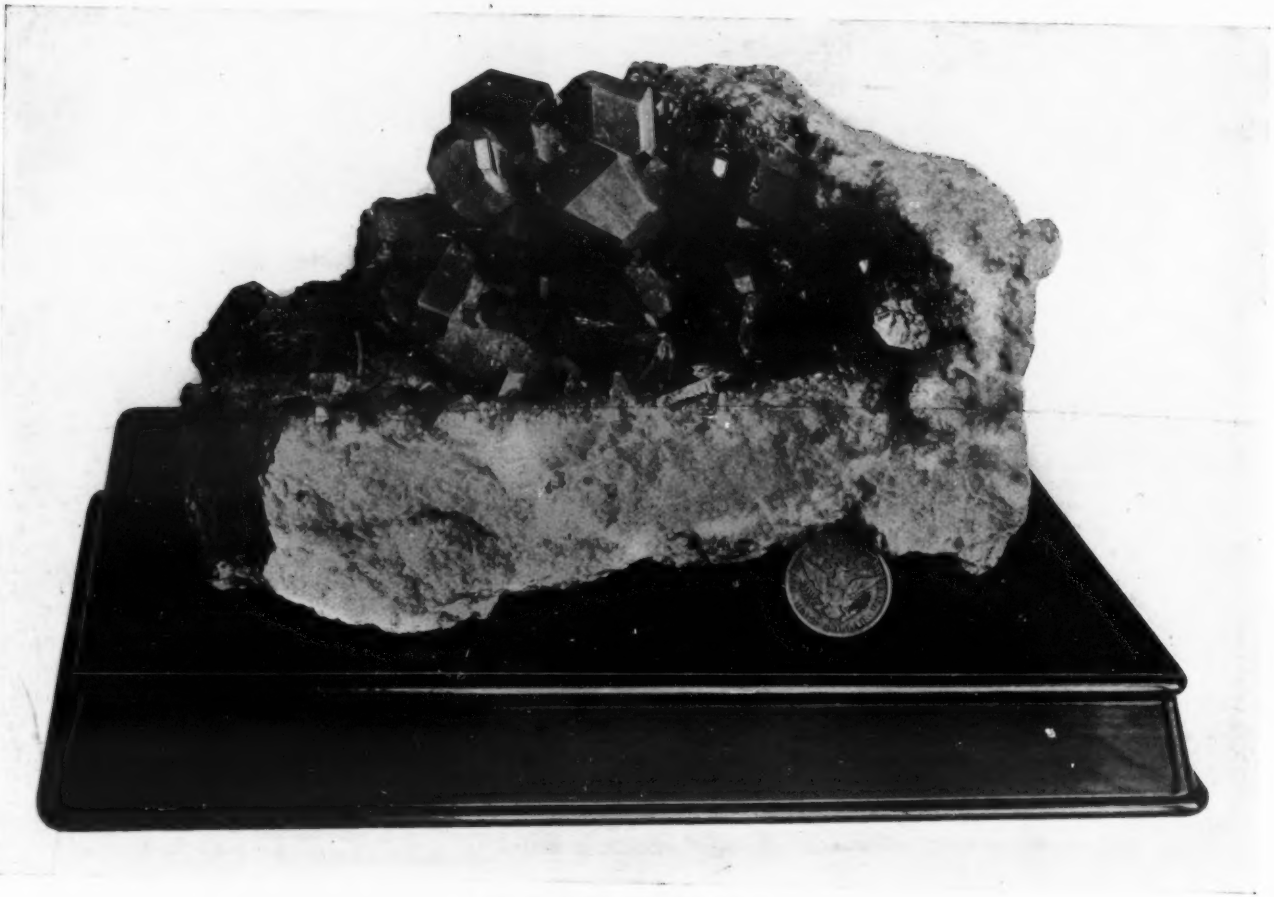
In the ten years following the acquisition of the Spang collection, many valuable gifts were added to the Museum's series, but preëminence among the exhibition collections in the country was not attained until the close of 1900, when J. Pierpont Morgan, Esq., purchased the Bement collection of minerals and meteorites and presented it to the Museum. This remarkable collection was brought together by Mr. Clarence S. Bement of Philadelphia. It is the result of the careful expenditure of a great deal of money, the purchases having been directed by exquisite taste as well as by scientific judgment. Although the Bement collection contains many rare species, its widespread fame has rested upon the variety of forms representing the com-

moner minerals and the exceptional perfection of the specimens. The present Museum collection is the combination of the material from all these sources, but owing to lack of space the Bement collection only is on exhibition, except in the wall cases.

Classification.

The classification of minerals in an exact sense was impossible as long as mineralogists adopted artificial systems based solely on color, hardness, source, weight or fanciful external resemblances. Only as the science of chemistry developed and as better methods of analysis were devised could a philosophical classification of minerals become possible. To chemical law mineralogy has adhered more and more closely, and while, to some extent, minor groups are founded upon crystallographic identity or similarity, the underlying basis of classification throughout is chemical composition. Minerals of the same chemical type are grouped together, and under that type minerals of similar physical or crystallographic features are arranged in smaller subdivisions. The forms of minerals are their most obvious characteristic. The six-sided prisms of Quartz and Beryl crystals, the rhomboidal or trapezoidal faces of Garnet, the triangular faces of Magnetite and the square faces of Fluorite are unmistakable. Observation at last passed beyond the first stages of curiosity or admiration and, slowly helped by many early students, and rapidly advanced by the genius of two or three, the branch of mineral science known as Crystallography has developed. Crystal form, furthermore, has been found to have close dependence upon chemical composition.

In the development of the nomenclature of the science the form of the names instituted by the ancients has been retained, and the termination *-ite*, derived from the classic Greek *-itis*, meaning *belonging to*, prevails. For example, Hematite, from the Greek word for blood, alludes to the red color of one mineral; Chlorite, to the green color of another, and Siderite, from the Greek word for iron, has reference to the chemical nature of a third. Several names which are exceptions to the rule, such as



SULPHUR FROM CIANCIANI, ITALY

Garnet, Idocrase, Quartz, Mica, Gypsum, Corundum and Spinel, have been so long in use that, like the names of the metals and elements, they must be retained.

According to chemical composition, therefore, the following principal subdivisions of minerals have been established:

I. The Native Elements.

II. The Arsenides, Sulphides, Antimonides, Sulph-arsenides, Sulph-antimonides and similar compounds.

III. The Haloids.

IV. The Oxides, anhydrous and hydrous.

V. The Oxygen-salts, such as Carbonates, Silicates, Phosphates, Columbates, Tantalates, Sulphates and Nitrates.

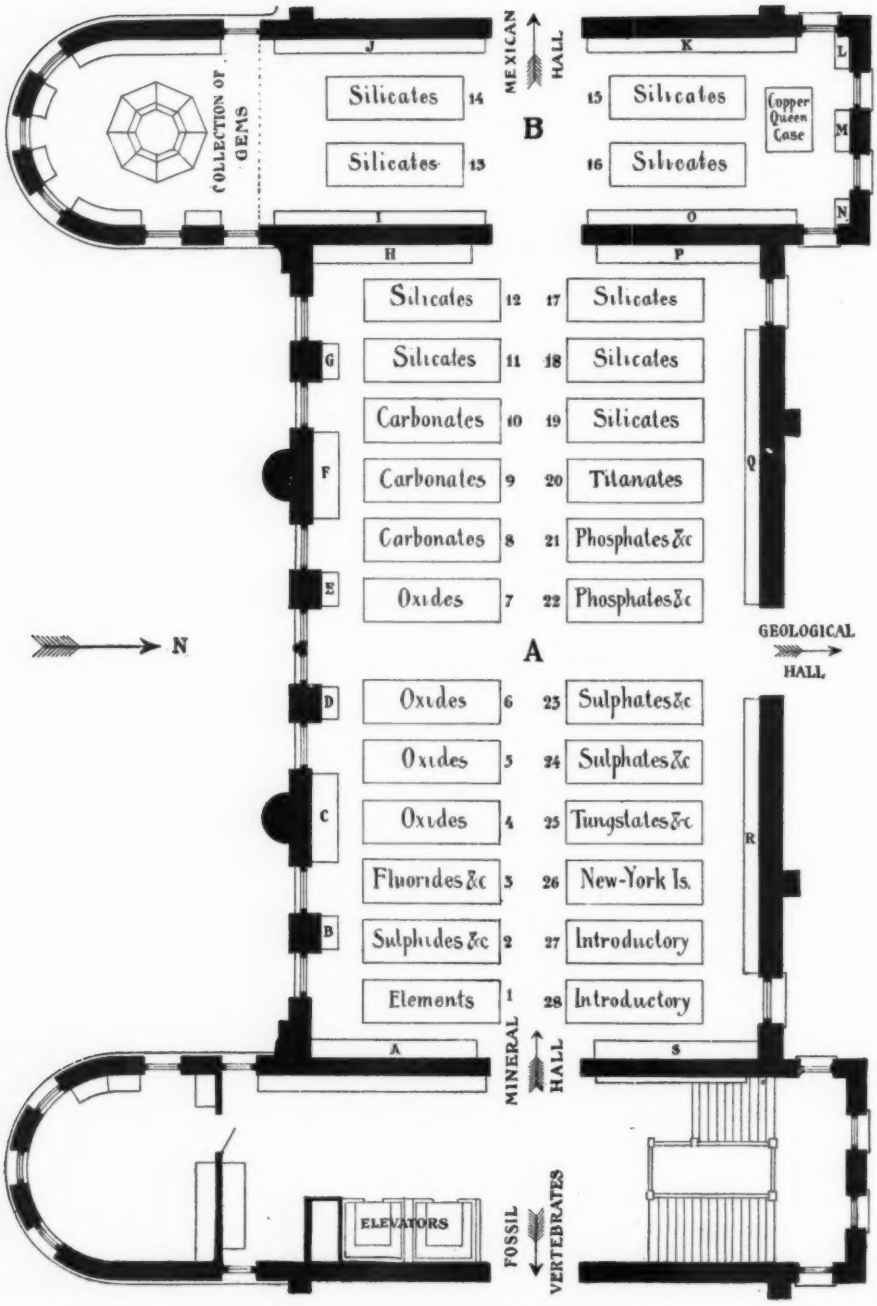
VI. The Hydrocarbons.

This system is almost universally used to-day, with changes, however, more or less material in the succession and interpretation of its various parts, and is practically the production of the last century.

Owing to the early activity of chemical agencies and the still continuing energy of oxygen, a gas which is constantly attacking uncombined elements, the list of Native Elements, as at present known, is much shorter than the list of elements known to chemistry, a large number of them being precluded from any independent existence whatever through their strong affinities for other substances. The mineralogist finds, however, in the portions of the earth accessible to him, a small list of native elements, of which six, at the most, are characteristically uncombined, while the remainder, about fifteen in number, are found native only under exceptional conditions, and one of them, iron, is particularly interesting because its most frequent occurrence is in the form of meteorites.

Guide to the Collection.

The collection of minerals is exhibited in two halls on the fourth floor of the Museum, marked "A" and "B" on the diagram, and is displayed in two sections, the wall case and the desk case exhibits. The wall cases contain those specimens which are



PLAN OF HALLS, DEPARTMENT OF MINERALOGY

too large for the desk cases, but the arrangement in the two series is the same. The systematic series in the desk cases is naturally far more complete than that in the wall cases. The specimens are arranged in accordance with the classification given in the sixth edition of Dana's System of Mineralogy, and the series in the desk cases begins at the left of the entrance to Hall A. It is intended to be studied from left to right along each side of every case, so that one advances from west to east along the south side of the hall, enters the small hall, B, and returns along the north side of the large hall to the end of the series at Case 25. Case 26 contains a collection of the minerals of New York and vicinity, and Cases 27 and 28 contain introductory series presenting the chemical and physical features of minerals, together with explanatory tables and photographs. The meteorites of the collection are now to be found in Cases 25 and 27, but they are soon to be arranged by themselves in cases along the center of the hall. At the head of every scientific subdivision will be found a statement, called here a "Rubric," detailing the principal members of the group, and giving their chemical composition and system of crystallization.

In the Museum collection the Sulphurs, Golds and Coppers are the most striking examples of the Native Elements.

The Sulphur specimens (Desk Case 1 and Wall Cases F and J) arrest attention on account of their beauty and perfect preservation. The crystallographic habit of the mineral is well known, steep pyramids beveled by the narrow planes of more obtuse pyramids, generally broad basal pinacoids, prisms, domes, hemipyramids and frequent sphenoids. An examination of the crystals will generally reveal upon the large brilliant faces curiously wrinkled and clouded surfaces which, under a magnifying glass, show densely crowded pits and irregular etchings. The sulphur deposits of the earth usually are found in connection with gypsum beds or near active or extinct volcanoes. The sulphur has been produced by separation from sulphuretted hydrogen. The mineral is found in large deposits in Wyoming, Nevada, southern Utah, and California.

Particularly choice are the specimens of Gold. The mineral is

shown here (Desk Case 1) in sheets like rolled metal; in plates, with crystallized edges; in braided filaments made up of minute octahedrons; in grouped octahedrons with hollow faces; in twisted plates frequently attached to quartz, around which it curls like some irregular yellow flower. Gold, from an elongation of the octahedron, assumes deceptive forms, while cavernous, skeleton and pitted crystals, peculiar distortions, reticulated and tree-shaped groups with spongy masses and rounded water-worn nuggets are common natural appearances of this precious metal.

Copper (Desk Case 1) is of especial interest, on account of the beautifully crystallized specimens in which it occurs. Most of our specimens have come from the remarkable deposits of Native Copper in the Lake Superior region of Northern Michigan. They exhibit the characteristic crystal forms of the metal, sprigs and branching crystals, twins and massive plates, the common tetra-hexahedron, cubes and superimposed octahedrons. Here will be found also examples of Copper and Silver which have been welded together by nature.

The next group of minerals is that comprising the Sulphides, Selenides and Tellurides of the metals and semi-metals, and the Arsenides and Antimonides of the metals, which are again succeeded by the so-called Sulpho-salts, in which the union of sulphur with arsenic or antimony is regarded as an acid, chiefly forming compounds with the bases, copper, silver, lead, iron, zinc and mercury. The great variety and number of mineral species resulting from the combinations thus made possible, are for the most part the source of many useful metals, and these combinations characterize the veins, crevices, fissures, caves and beds of mining regions.

One of these, Stibnite, the sulphide of antimony, is a valuable ore (Desk Case 1, Wall Case F). This species affords the mineralogist very beautiful, lustrous, well-terminated prismatic crystals, usually clustered in radiating groups. The striking specimens here displayed, together with many others which have supplied the cabinets of the world, were found at Mt. Kosang near Seijo, province of Iyo, Shikoku Is., Japan. In their size and beauty and

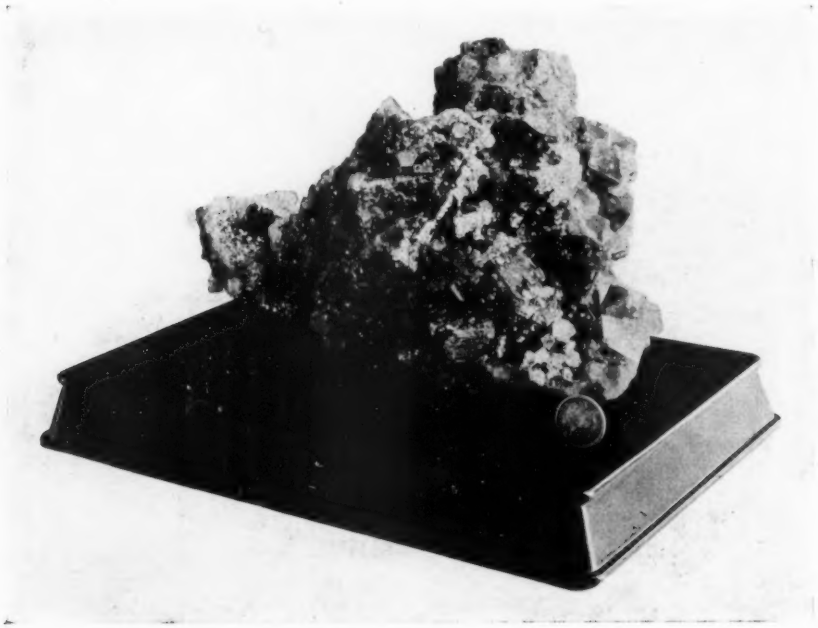
in the complexity of their forms, they surpass the specimens of the same species from all other localities. They increased the number of known crystalline planes of Stibnite from forty-five to eighty-five. Galenite, the sulphide of lead, and Sphalerite, the sulphide of zinc, are represented by beautiful specimens in Desk Case 2 and Wall Cases F and J. Pyrite, the sulphide of iron (Desk Case 2, Wall Case H) is a very common species, and is very strik-

STIBNITE FROM MT. KOSANG, JAPAN

ing on account of its brilliant cubes, dodecahedrons and other crystal forms.

The group of Haloid compounds follows the foregoing division, and is composed of the unions of the elements chlorine, fluorine, iodine and bromine with basic atoms of the metals. The admixture of oxygen produces oxy-salts, and of combined water makes hydrous salts. In this section Fluorite is prominent (Desk

Cases 3 and 4, Wall Cases H and J). In every large collection this mineral offers a splendid display of colors and associations, and in the Bement collection the series of specimens is especially attractive. From Cumberland, England, there are elongated cubes with attached Calcite crystals; large cubes coated with crystals of Quartz; purple and green cubes densely ruled with fine lines, which indicate oscillations of crystal development;



FLUORITE COATED WITH QUARTZ, CUMBERLAND, ENG.

green cubes from Cornwall with feathery edges of purple, inclusions of black specks and interior colored boundaries (phantoms); also from Brienz, Switzerland, crystals with low scallop-like depressions, pyramidal pits, wrinkling lines and pin-holes, the whole resembling an eroded or half melted ice-block; from Saxony, yellow cubes with Galenite; magnificent pink octahedrons from Switzerland, some of them with blunted or rounded angles made by the planes of the trigonal trisoctahedron.

The Oxides follow the simple compounds of the metals and

QUARTZ FROM MAGNET COVE, ARKANSAS

semi-metals and represent the combination of oxygen with metallic bases. They form one of the most important classes of minerals, and among them are found many of the valuable ores, while Quartz, the oxide of silicon, is the most widely distributed of all the rock-making minerals. In this section, Hematite, Corundum, Spinel, Magnetite, Franklinite and Rutile present some of the most brilliant phases of the mineral world (Desk Cases 6 and 7, Wall Cases I and J).

Quartz, including the chalcedonic forms of silica (Desk Cases 4 and 5, Wall Cases H, J, K, P), is the most prized, the most beautiful and the most varied of all minerals. In color, form and physical constitution, it assumes so many aspects, and the changes from one form to another are so gradual that its complete illustration is almost impossible. It crystallizes in the hexagonal system and usually has the form of a six-sided prism terminated by a pyramid. In the Bement collection its great diversity of development is well shown. Quartz occurs in easily visible particles in granite and many other igneous and metamorphic rocks, in sandstones and quartzites and, as a deposit from aqueous solution, in cavities and crevices in all kinds of rocks. It is the common vein material of mountainous and ore-bearing regions. The absorption of iron and other metallic oxides produces many colors, especially in the various chalcedonic forms of silica.

Following the Oxides are the Carbonates, which form a very important group. The carbonates of lime and magnesia constitute the limestones, while the carbonates of iron and copper are valuable ores. On account of their beauty, many Carbonates,—for example, Marbles, Malachite, Azurite and Mexican Onyx,—take a conspicuous position in a mineral cabinet. The carbonates have been formed by the combination of carbon dioxide with various bases, and the union in many instances has been brought about through the agency of water carrying the carbon dioxide in solution. This has dissolved the base of the salt, the whole being re-deposited afterward from a more or less saturated fluid on a further change of conditions.

In this series the Calcite, Aragonite, Malachite, Azurite, Sider-

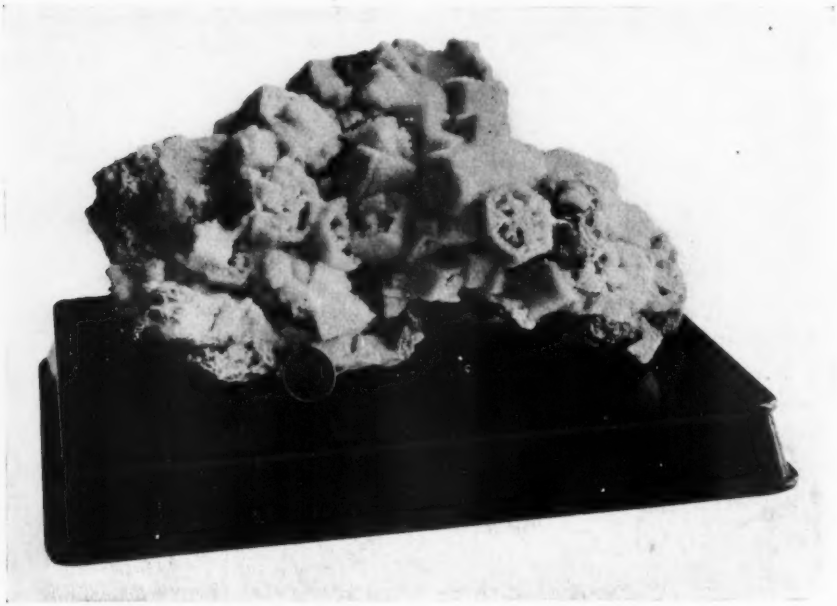
ite and Rhodochrosite specimens furnish a long display of forms and colors (Desk Cases 8–10, Wall Cases I, J, K, O, Q).

The Silicates embrace the larger number of mineral species and are the essential components of the crystalline rocks. They are unions of basic elements (the oxides of various metals) with the several forms of silicic acid. The group is subdivided into

AZURITE FROM BISBEE, ARIZONA

two sections: the Anhydrous and the Hydrous Silicates, and these again are broken up into smaller groups based upon similarity of their members to one another in regard to composition, crystallization and optical qualities. Among the Silicates there are several well-marked and compact groups, such as the Feldspars, the Pyroxenes, the Amphiboles, the Garnets, the Sodalites and the Scapolites.

A chemical feature of the greatest importance in the constitution of the silicates is the replacing power of the bases, whereby one or more basic molecules take the place in whole or in part of another in the chemical composition of a mineral. For instance, the sesquioxide of alumina (Al_2O_3) can be replaced by the sesquioxide of iron (Fe_2O_3), except in the feldspars; and, similarly, lime (CaO), magnesia (MgO) and protoxide of iron

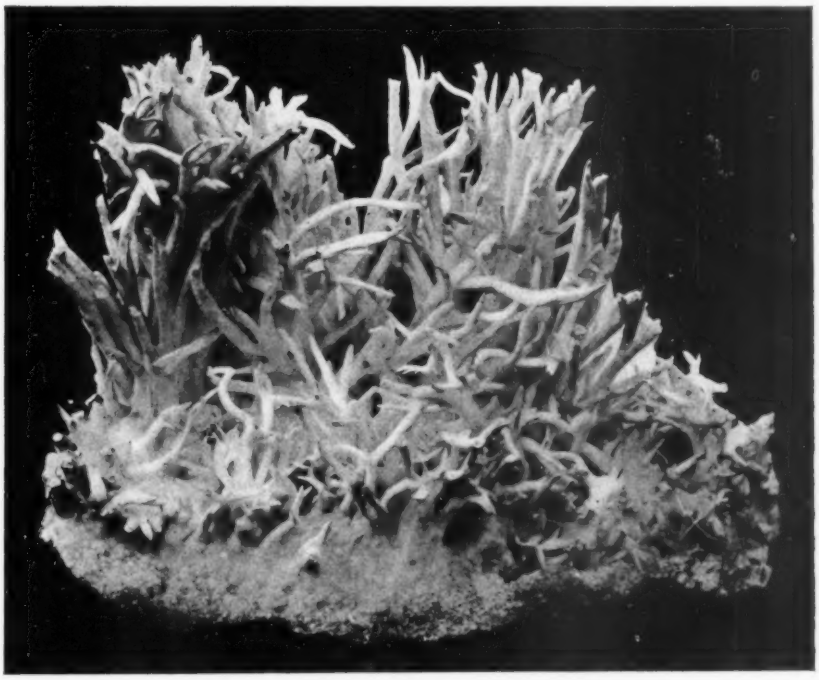


CALCITE PSEUDOMORPH AFTER ARAGONITE, CIANCIANI, ITALY

(FeO) are substituted for one another; or any of these can take the place of the oxides of potassium and sodium (K_2O, Na_2O). This replacing process comes prominently into view in Garnet, in which with the same theoretical formula for a very large group the composition of the different varieties is different through the effect of this law. Another, and simpler, instance is the series of compounds connecting Siderite ($FeCO_3$) with Calcite ($CaCO_3$).

Among the silicates may be mentioned Feldspar (Desk Case 11, Wall Cases K and O), Pyroxene (Desk Case 11), Amphibole

(Desk Case 12), Beryl (Desk Case 12, Wall Case O), Garnet (Desk Cases 12 and 13, Wall Cases K and O), Zircon (Desk Case 14, Wall Case K), Topaz (Desk Case 14, Wall Case K), Tourmaline (Desk Cases 15 and 16, Wall Case Q), the Zeolites (Desk Cases 16 and 17, Wall Case Q), Mica (Desk Case 18, Wall Case Q), Serpentine (Desk Case 19, Wall Case Q), and Talc (Desk Case 19,



ARAGONITE ("FLOS-FERRI") FROM STEIERMARK, AUSTRIA

Wall Case Q). Besides these there is a host of less important species. In Wall Case K may be found a beautiful example of Rhodonite, the silicate of manganese. This interesting mineral has a remarkable development in the zinc area of northern New Jersey, and the exceptional group of prisms illustrated on page 19 is from Franklin in that State.

Beyond the silicates are the salts, or compounds with bases, of the other oxygen acids. Here come in order the Titanates,

Phosphates, Vanadates, Arsenates, Antimonates, Columbates, Tantalates, Borates, Tungstates, Molybdates, Sulphates, Chromates and Nitrates. These are to be found in Desk Cases 20–25 and in Wall Case Q, but it is impossible in this brief review of the collection to dwell upon the interest and beauty of the many species assembled in this section.

Prominent among them, on account of the great beauty of

MALACHITE FROM BISBEE, ARIZONA

its mineralogical development, is the sulphate of barium, or Barite, (Desk Case 23, Wall Case Q). This is a handsome species not remarkable for crystalline variety, but often grouped in sheaves of radiating plates, frequently massive and banded, occasionally globular, fibrous or granular. The crystals are commonly tabular, somewhat modified on the edges, and frequently are tinged yellow, red, green, blue or brown. Barite is found in metallic veins and is of especially common occurrence in lead

RHODONITE FROM FRANKLIN, NEW JERSEY

mines. In recent years extraordinarily beautiful specimens of this mineral have been found in England.

As the visitor completes this preliminary survey of the Hall

BARITE FROM CUMBERLAND, ENGLAND

of Minerals, it is suggested that he review his impressions in the light of these general reflections:

First, that in the inorganic or mineral world the forces governing the molecular arrangement of matter in crystalline forms, and the affinities governing the chemical combination of elements, rule universally;

Second, that the minerals of the earth's surface necessarily are the sole source of all the elements useful in the industries and the arts;

Third, that minerals appeal to our sense of beauty, and are as much to be regarded as objects of artistic appreciation as are the beautiful colors and forms of the animal creation.

BARITE FROM CUMBERLAND, ENGLAND

Guide Leaflets to Exhibits

IN THE

American Museum of Natural History

No. 1. THE BIRD ROCK GROUP. By FRANK M. CHAPMAN, Associate Curator of Mammalogy and Ornithology. October, 1901.

No. 2. THE SAGINAW VALLEY COLLECTION. By HARLAN I. SMITH, Assistant Curator of Archæology. December, 1901.

No. 3. THE HALL OF FOSSIL VERTEBRATES. By W. D. MATTHEW, Ph.D., Assistant Curator of Vertebrate Palæontology. January, 1902.

No. 4. THE COLLECTION OF MINERALS. By LOUIS P. GRATACAP, A.M., Curator of Mineralogy.

American Museum of Natural History.

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